MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

EEN1026 – ELECTRONICS II
(TE/RE)

9 MARCH 2020
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 6 pages including cover page with 4 Questions only.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. State all the assumptions clearly.

Question 1

a) A dc analysis of the source-follower network of Figure Q1(a) results in $V_{GSQ} = -2.86V$ and $I_{DQ} = 4.56$ mA. Determine the following:

i. Transconductance, g_m. [4 marks]

ii. Input impedance, Z_i. [2 mark]

iii. Output impedance, Z_o, with and without r_d. Compare the results. [4 marks]

iv. Voltage gain, A_V with and without r_d. Compare the results. [5 marks]

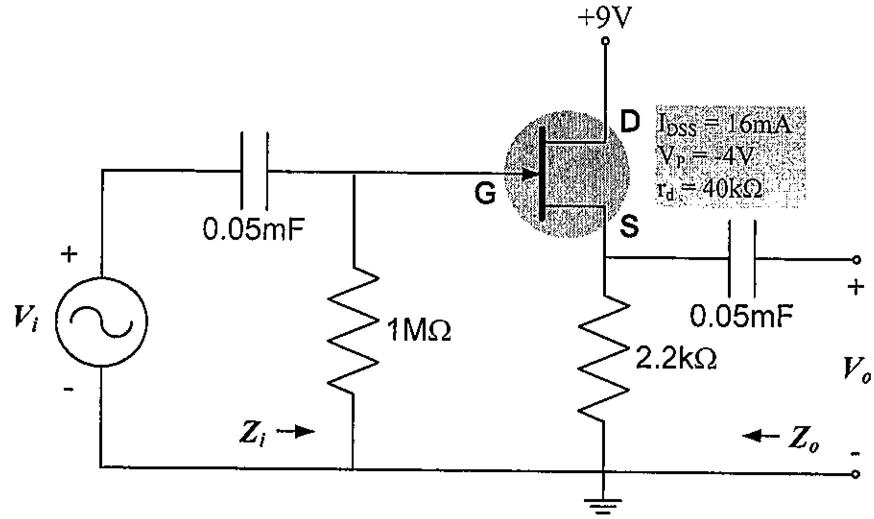

Figure Q1(a)

b) For the common-emitter amplifier network shown in Figure Q1(b), draw its *small-signal h-parameter* equivalent circuit. [3 marks]

Given $R_C = R_L = 800\Omega$, $R_i = 0$, $R_1 = 1.2k\Omega$, $R_2 = 2.7k\Omega$, $h_{re} \approx 0$, $h_{oe} \approx 100\ \mu S$, $h_{fe} = 90$ and $h_{ie} = 200\Omega$. Calculate the

i. voltage gain A_V and [4 marks]

ii. current gain, A_i. [3 marks]

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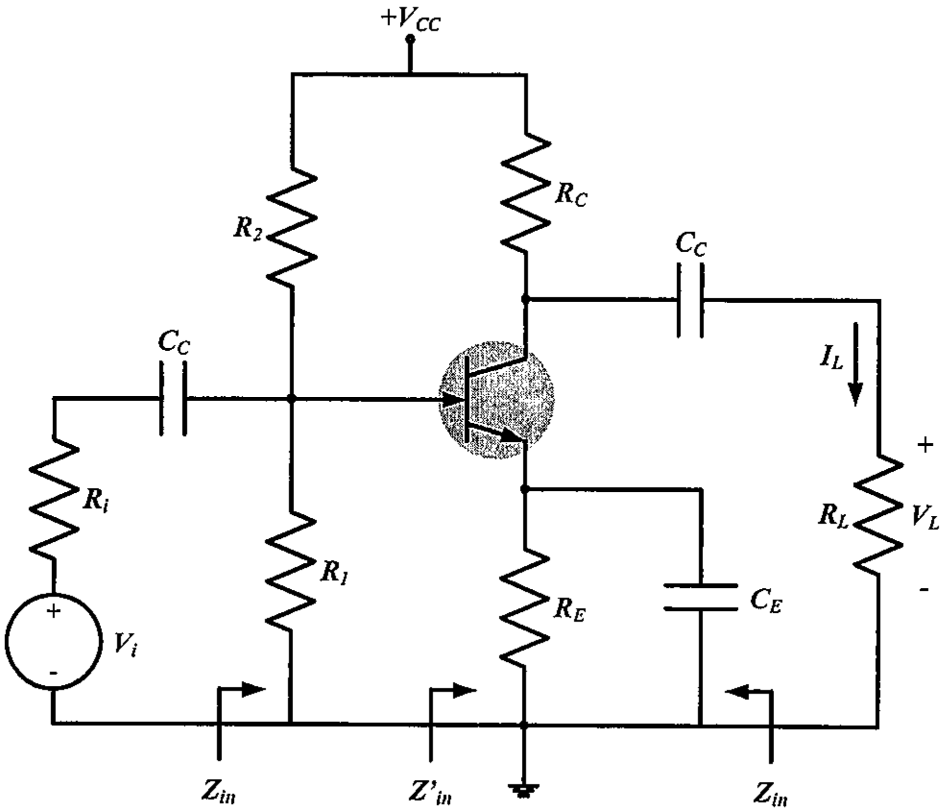

Figure Q1(b)

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Question 2

a) Briefly explain the following noise:

i. Thermal noise [3 marks]

ii. Shot noise [3 marks]

b) Figure Q2 below is an amplifier circuit with h_{ie} = 2 kΩ and h_{fe} = 50, respectively.

i. Draw its ac equivalent circuit and determine the mid-band gain, $A_{V(mid)} = V_O / V_i$. [5 + 4 marks]

ii. Calculate the input impedance, Z_i. [2 marks]

iii. Determine the lower cutoff frequency, f_{LS} (due to the signal source coupling capacitor), f_{LC} (due to the output coupling capacitor) and f_{LE} (due to the emitter capacitor). [6 marks]

iv. What is the effective lower cutoff frequency of the amplifier? [2 marks]

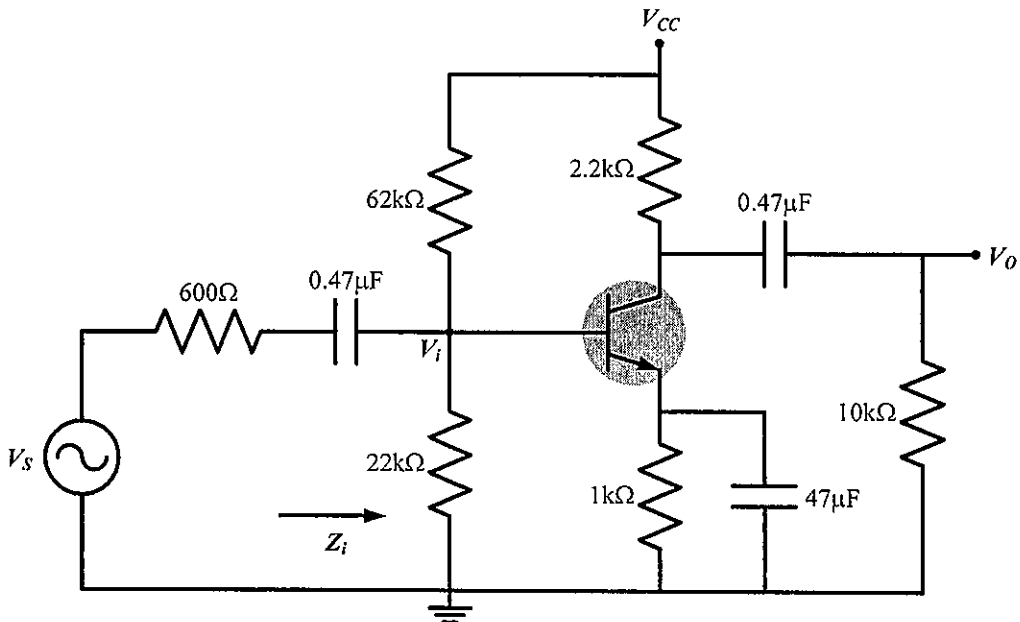

Figure Q2

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Question 3

a) Class B power amplifier circuit is known to have higher efficiency than Class A. Explain why. [3 marks]

b) A Class C amplifier is driven by a 200 kHz signal. The transistor is ON for 2 μs and the amplifier is operating over 100% of its load line. Given the saturation collector current is 300 mA, determine the average power dissipation of the transistor if $V_{CE(sat)}$ is 0.2 V. If V_{CC} is 24 V and R_C is 100Ω, what is the efficiency of the circuit? [7 marks]

c) Figure Q3 is a particular class amplifier circuit configuration. If the input resistance of the amplifier circuit is 5 kΩ,
   i. identify the class of the power amplifier circuit and give a reason, and [3 marks]
   ii. determine its power gain. [5 marks]

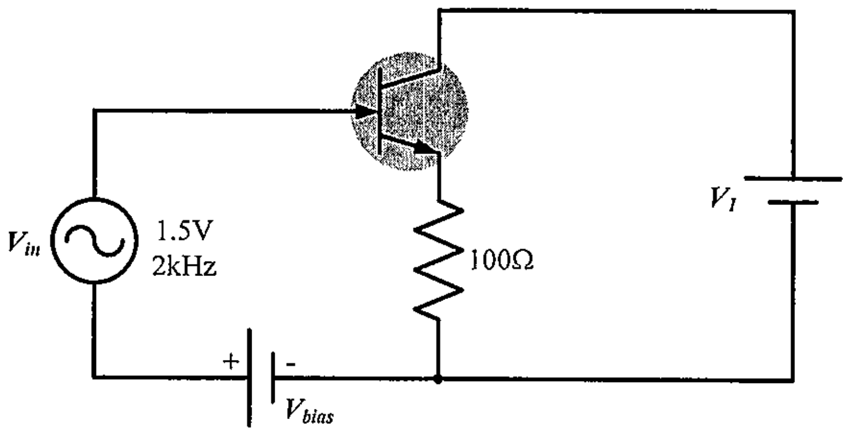

Figure Q3

d) With the help of a simple diagram, shows how to locate the *operating point* of a Class A amplifier on the load line characteristics plot in order to get the maximum output signal. Include the collector current and collector-emitter voltage signals on the same load line characteristics as well. Label the diagram clearly. [7 marks]

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Question 4

a) A 555 timer is configured to run in the *astable* mode as illustrated in Figure Q4(a). Given that $R_1 = 2.2\ k\Omega$, $R_2 = 4.7\ k\Omega$, $V_{CC} = 5.5$ V and $C = 0.022\ \mu F$.

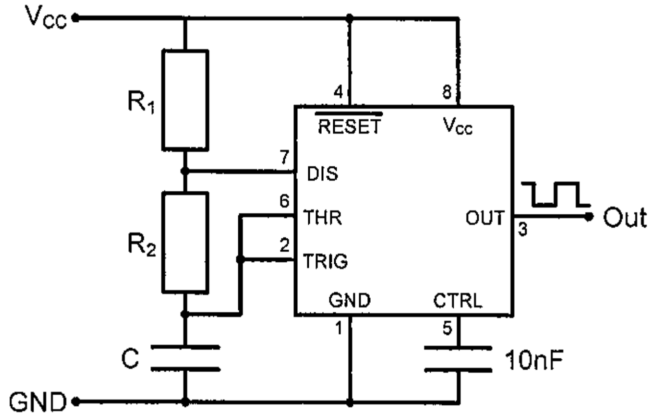

Figure Q4(a)

i. R_2 is chosen to be larger than R_1. Explain why. [2 marks]
ii. Determine the output frequency. [3 marks]
iii. Determine the duty cycle. [2 marks]
iv. What will happen when a diode is connected across R_2 in the 555 timer? Solve for the running frequency, f_r and the duty cycle after a diode is connected across R_2. [6 marks]

b) Determine the upper threshold point (UTP) and lower threshold point (LTP) values of the non-inverting Schmitt trigger in Figure Q4(b). [8 marks]
Then sketch and label the input and output waveforms when V_{out} is 10 V. [4 marks]

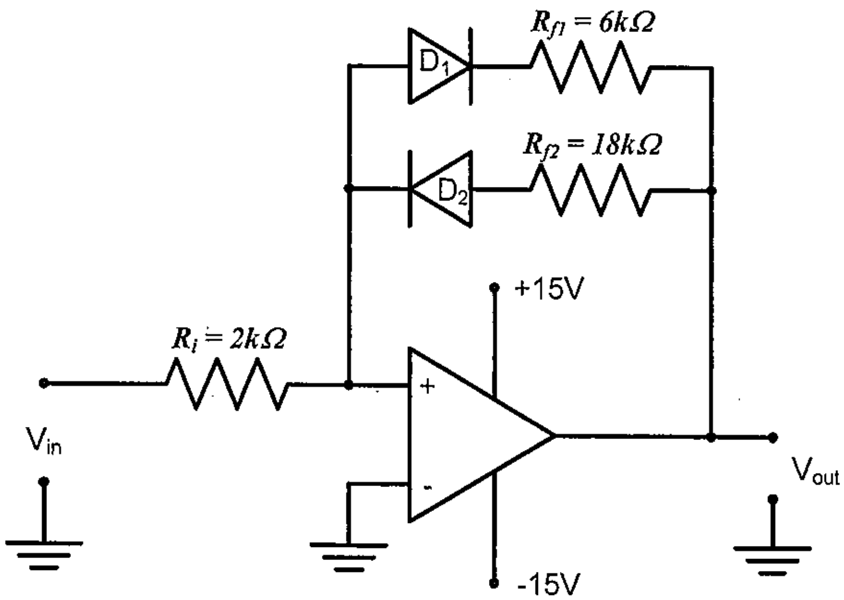

Figure Q4(b)

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